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# HERE'S HOW ....a guide to tree planting in the California Pine Region

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FOREST SERVICE

U. S. DEPARTMENT OF AGRICULTURE

# FOREWORD

We foresters are in the business of growing trees. If we can get them started by managing our stands properly--fine. Wherever we can't, we've got to plant. How to do a better job of planting is outlined in this booklet. Let's follow its suggestions. Our planting efforts should result in not dead statistics of so many acres planted, but living examples of our abilities as foresters to do the planting job well and follow through until a good stand of reproduction is assured.

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AGRICULTURE -- Berkeley

# HERE'S HOW - - - a guide to tree planting in the California pine region

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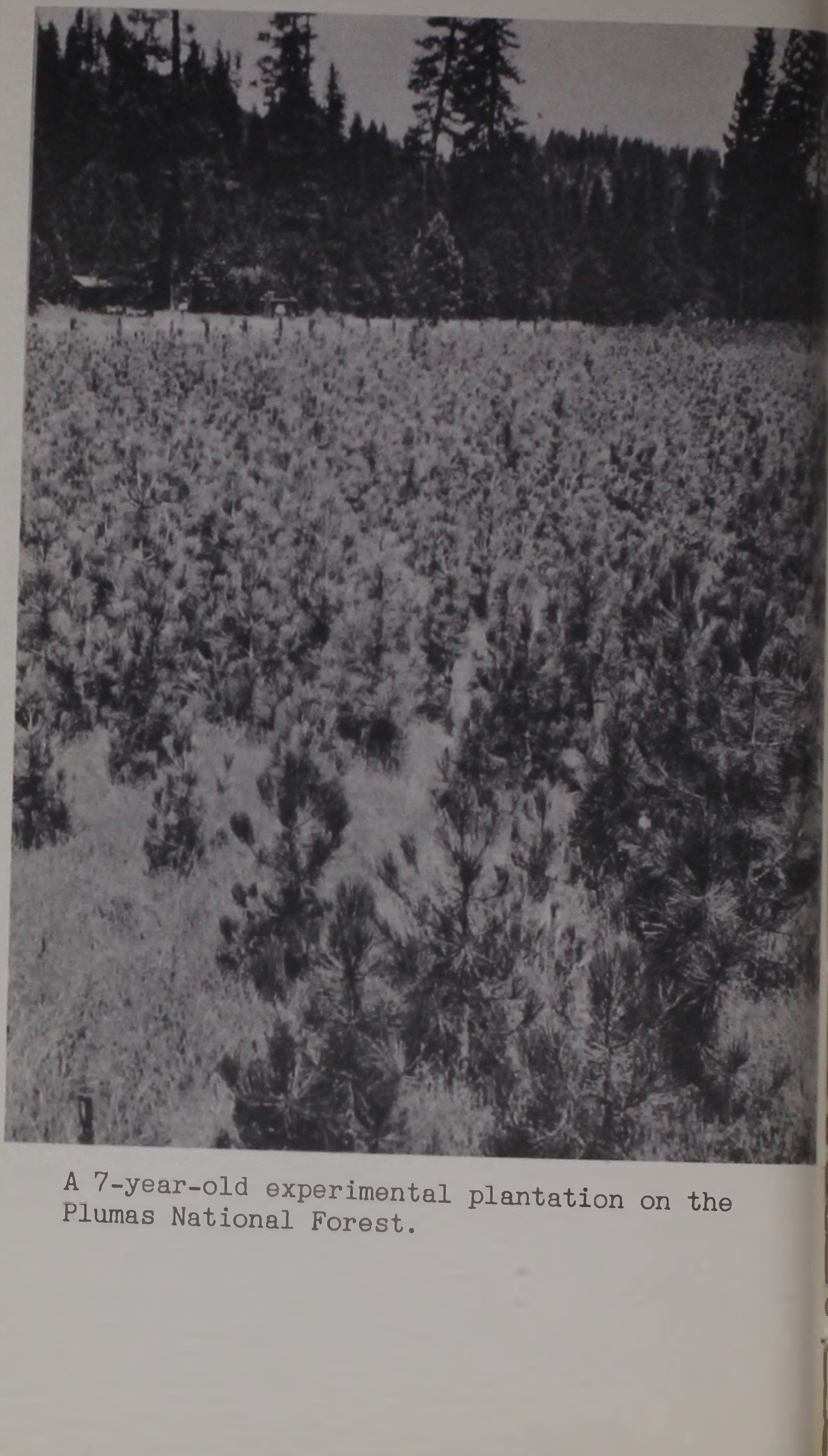


A 7-year-old experimental plantation on the Plumas National Forest.

Many thousands of acres of burned or cut-
ver pine timber land in California need to be
eforested. But natural seedfall can not al-
ays be depended on to do the job. Sometimes
o seed trees, or too few of them, survive fire
r logging. Even when adequate seed trees are
eft, a light seed crop or damage by seed-eating
odents may result in a poor stand of trees.
wenty-five years or more have gone by before
ome cut-over areas were even partly stocked
ith seedlings. Natural regeneration, of course,
s preferred, but foresters do not want to wait
his long to start another tree crop. Further-
ore, they sometimes find that the natural seed-
ings are not the tree species they want to grow
r that brush soon covers the ground so completely
hat too few or even no trees can grow. Then
hey must turn to artificial regeneration, either
y sowing seeds or planting trees.

Now, you undoubtedly have heard that seed-
ing or planting forest trees is a difficult job
in California. It is, but it is not impossible.
Both practical experience and the findings of
research have shown that seeding or planting
can succeed--if done

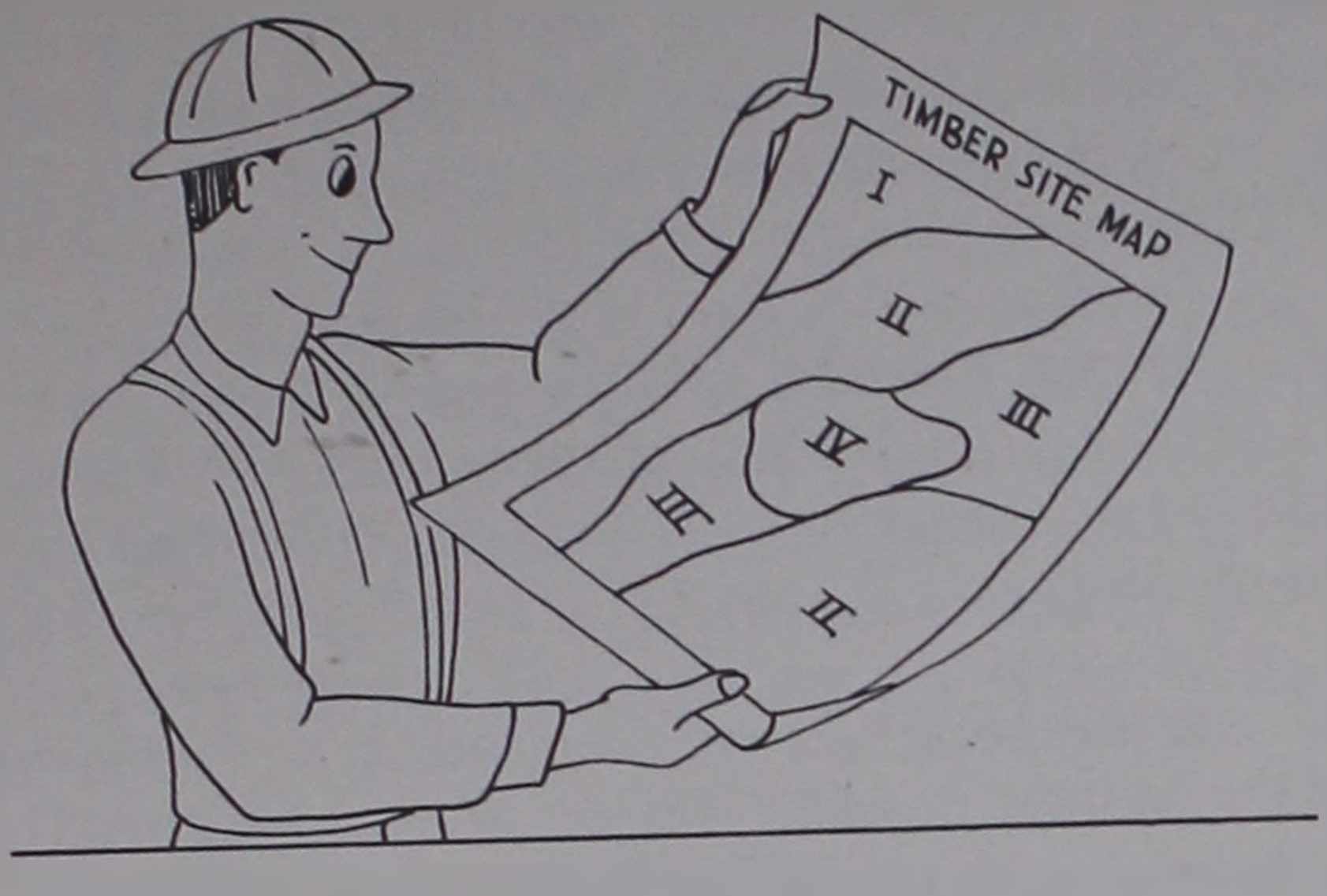
in the <u>right place</u>
at the <u>right time</u>
with the <u>right stock</u>
in the <u>right way</u>

In this booklet we are going to summarize these points to help you do a better job of getting the new forest started.

# THE RIGHT PLACE

Obviously you'll want to choose the place where your available money and manpower will do the most good. In general this means the areas having high site quality for timber and no competing vegetation. Throughout the California region plantations on good timber sites have been more successful than those on poor sites. Also, on timber burns, plantings made within a year or two after the fire have been more successful than those made later when brush, grass or other competing vegetation has become established. Here is the reason. In this climate, the young trees must get their water from moisture already in the ground by the beginning of summer. But brush or grass with established roots will quickly use up the moisture needed for tree growth. If you find much competing vegetation on an area you'd like to plant, then, you must first destroy the competition.

On good way to do this is to clear the brush in strips 10 to 12 feet wide, with bulldozers. Narrower strips just <u>will not</u> be effective. The strips should be spaced 20 feet apart on center, and trees planted 6 feet apart down the center of the strips. At this spacing there will be about 350 trees per acre. On slopes where erosion is a hazard, strips should follow the contour, or run across the slope. Instead of strips, you can use cleared blocks about one chain square, with the blocks one chain apart. Plant the trees at 6 x 6 spacing, at least 5 feet away from the cleared edge.




Burning is another way to clear the ground where danger of erosion is not excessive. However, brush seedlings and sprouts will come in after the fire. They must be controlled. You can do this by bulldozing, ripping, or disking strips through the planting area, or by spraying the sprouts and seedlings with an herbicide. Sprouts of many common brush species, including bear clover, can be killed with a water solution of 2,4-D or 2,4,5-T at a concentration of 2,000 to 3,000 parts of acid per million. One hundred gallons of this solution, sprayed under pressure, will cover an acre effectively.

Another consideration when you select the right place to plant is the possibility of damage by deer or rabbits. These animals have destroyed entire plantations, and no practical method of controlling them in such large areas is known at present. If you find evidence that rabbits or deer are concentrated on an area, choose some other place to plant.

Of course you don't want to waste money planting trees where livestock congregate, as along stock driveways, around waterholes, close to meadows, and similar places.

If you are choosing among several possible planting sites, here are some priorities established to guide your selection--the best places listed first:

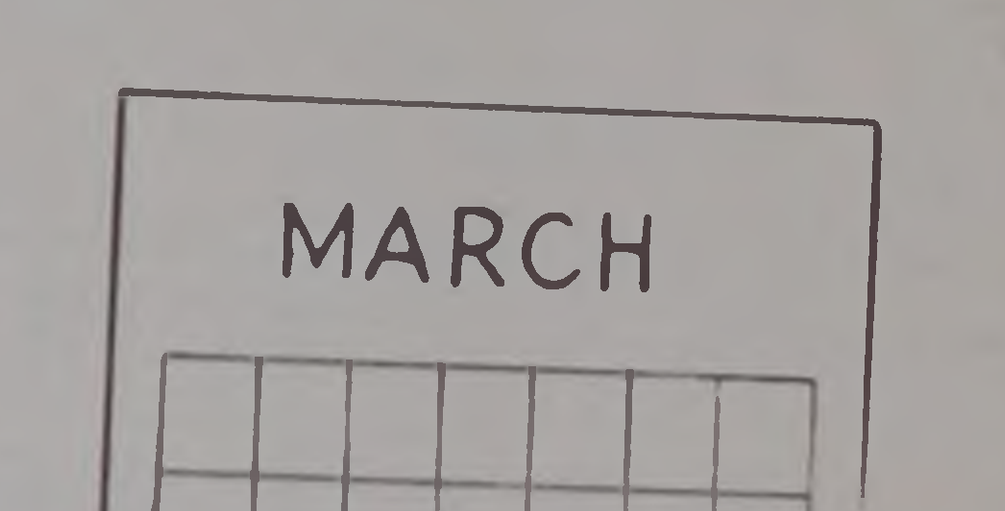
1. Areas burned or logged 1 to 3 years ago, with little or no brush cover, and of timber site quality I through III (soils normally 4 or more feet deep).

2. Areas burned or logged 4 or more years ago, with brush coming in or already forming a dense stand, and of site quality I through III (soils normally 4 or more feet deep).

3. Areas burned or logged 1 to 3 years ago, with little or no brush, and of site quality IV and V (soils normally 2 to 3 feet deep).

4. Areas burned or logged 4 or more years ago, with brush coming in or already established, and of timber site quality IV and V (soils normally 2 to 3 feet deep).

Maps of forest soils (the vegetation-soil maps prepared by the California Forest and Range Experiment Station) may be available for your planting areas. Use them to help establish priorities when the timber site quality is not known.



# THE RIGHT TIME

When it comes to picking the time to plant, spring is your best bet. Both fall and spring planting have been tested in California. Results have been equally good in the two seasons when freshly lifted stock was used, planting was carefully done, and soil moisture and the weather were favorable. But because favorable conditions are less likely to prevail in the fall, planting in the spring is more likely to succeed.

Of course you may have to plant in the fall at the higher elevations, where snow covers the ground until late in the spring. By the time the snow melts from these areas, the weather is apt to be too warm and too dry for planting. If you must plant in the fall, make sure the soil is thoroughly wet at least a foot deep. Don't rely on the first fall rains, though. They seldom wet the soil evenly, particularly on recently logged areas, so you should check the soil moisture before starting to plant. The only way to be sure is to dig some holes and see whether the soil is really wet down to a depth of one foot.

You may seed either in the fall or in the spring. In the fall it is not necessary to wait until after the rains; however, late-fall sowing is best because early seeding lengthens the period during which seed is exposed to rodents. Spring-sown seed should be stratified for prompt germination.

To sum up, here's a rule of thumb for picking the right time: Plant in the spring as early as possible or in the fall, when necessary, as late as possible.

# THE RIGHT STOCK

Using the right stock means you have these things to consider: Seed source, quality and age of stock, and tree species. Seed source is important to make sure that trees in the plantation will be adapted to local growing conditions. Except for proved superior strains or exotic species of trees, it is safest to sow seed collected in an environment like that of the planting site. If you are to sow seed directly on the site, know which one of California's 13 seed collection zones contains the planting site. Use only seed from that zone. And if you are ordering planting stock from a nursery, specify the seed zone in which the stock will be planted.

It is the nursery's job to provide you the best stock for your planting job. The trees are graded for quality at the nursery so that only those with good top and root growth are shipped out. A minimum stem diameter of 0.11 inch has been set for grade 1 ponderosa pine and Jeffrey pine stock. (Size grades have not yet been established for other species.)

Ordinarily you will receive from the nursery trees that have been 1 year in the seed bed and 1 year in transplant beds, or 1-1 transplants. This age class of planting stock has consistently survived well. Older classes, such as 1-2 and 2-1, have not been enough better to justify the extra cost of producing

them. Cheaper trees, such as 1-0 and 2-0 root-pruned stock, have given satisfactory survival under favorable planting conditions, but it still is not possible to predict just when this stock can be used successfully. You will have more consistent success if you use 1-1 transplants.

For most of the planting for timber growing purposes the species to use will usually be either ponderosa pine or Jeffrey pine. They grow well in most localities where you will be planting in California. You should order ponderosa pine for planting at the lower elevation sites, say 5,000 to 6,000 feet or below. Order Jeffrey pine for higher elevations because this species seems to be more cold resistant than ponderosa pine. Where the two species naturally merge, or have grown in mixed stands, you can plant either one successfully.

Douglas-fir, sugar pine, white fir, and red fir are also desirable for planting. Planting stock of these species is not available now and probably will not be until there are better facilities for producing it. When they do become available, select those species native to the planting site. Sugar pine, though, should be planted only within blister rust control units where it will be protected from the white pine blister rust disease.

In a nutshell, then, the <u>right stock</u> means: species adapted to the site, correct seed zone, proper age, and graded for quality.

# THE RIGHT WAY

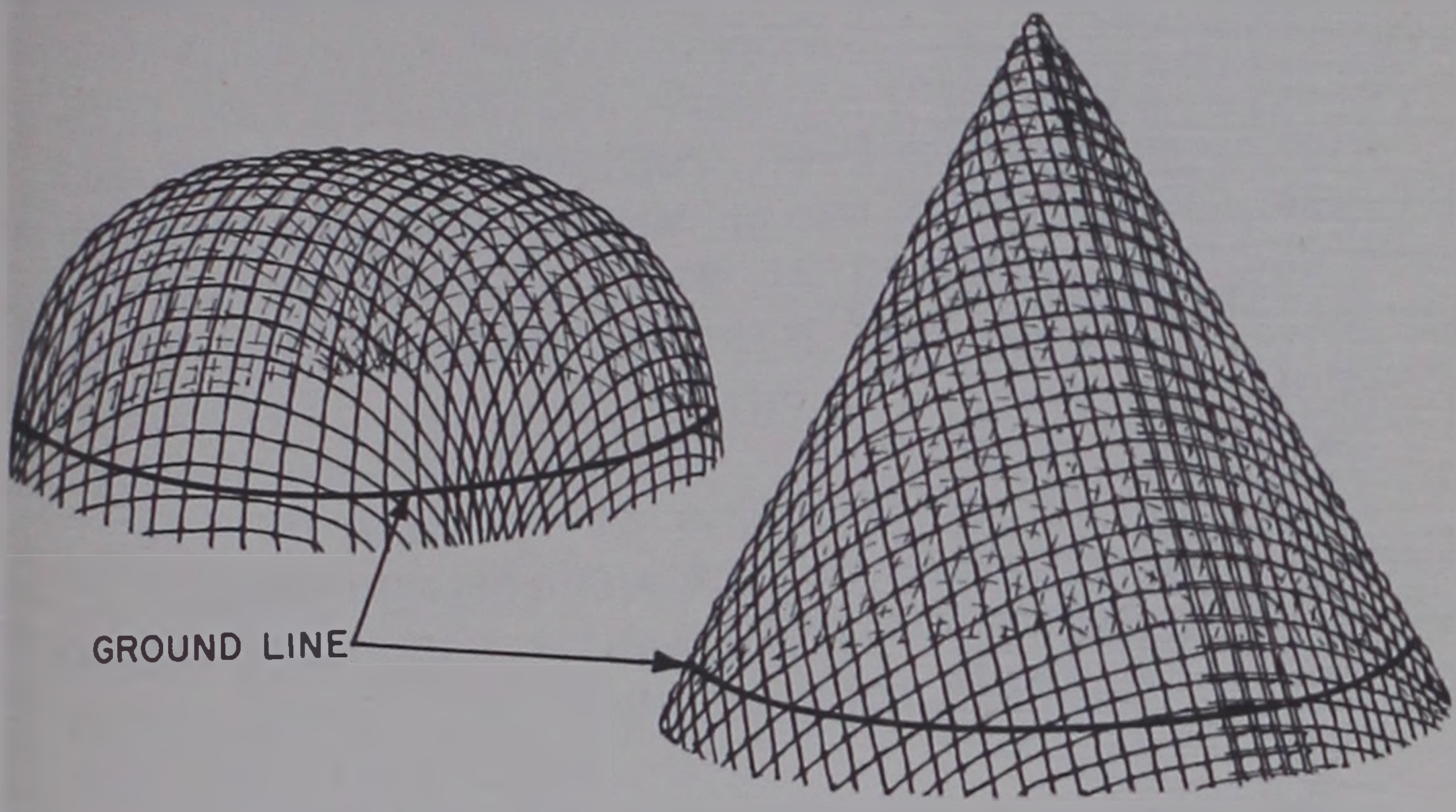
A good start in life is important. Whether the plantation is to be started by sowing seed directly in the field where the trees are to grow or by planting nursery-grown trees, this stage in the plantation's life is critical. Yet there is no secret to success. What you need to do is give the young plants the best start possible and then protect them from destructive pests.

## Direct Seeding

For direct seeding the right way requires that you take three essential precautions. The first of these is to provide the proper seed bed, which for pines is mineral soil. The second is to protect the seed from rodents, which have been the most common cause of failure in direct-seeding projects. The third is to free the tender seedlings from competition by brush and other vegetation.

Sowing the seed in spots, rather than broadcasting it over the ground, seems to be the most practical method of direct seeding. So far direct seeding has been successful in only a few of the times it has been tried on a large scale in California. Broadcast sowing has been unsuccessful in nearly every trial. But when rodents were controlled, spot seeding has been as successful as planting.

Covering the seed spots with screens is the most effective method now known for preventing damage by rodents. No way of treating the seed with poison or repellents, or of encasing it in a pellet, has yet been found to keep the rodents away. These measures are being studied, however, and an effective one may be found.




You can make the screens of quarter-inch mesh hardware cloth, giving them a dome or cone shape so that the small seedlings will have room to grow. For pine plantations, here's how you use the screens:

1. Plan on at least 680 spots per acre, that is, a spacing of 8 feet by 8 feet. You'll need 5 seeds for each spot. That many is necessary because under ordinary conditions the chances are about 1 in 4 that a seed will germinate and the seedling live.

2. At each seed spot scrape away litter and trash so that mineral soil is exposed in a foot-square area. If ground cover is heavy, scalp off the vegetation with the planting tool. If the spot is near a clump of brush, move 4 or 5 feet away, even if this means you cannot stick to a regular pattern of 8 by 8 spacing.

3. Put the 5 seeds on the prepared seedbed and cover them with one-quarter to one-half inch of soil.

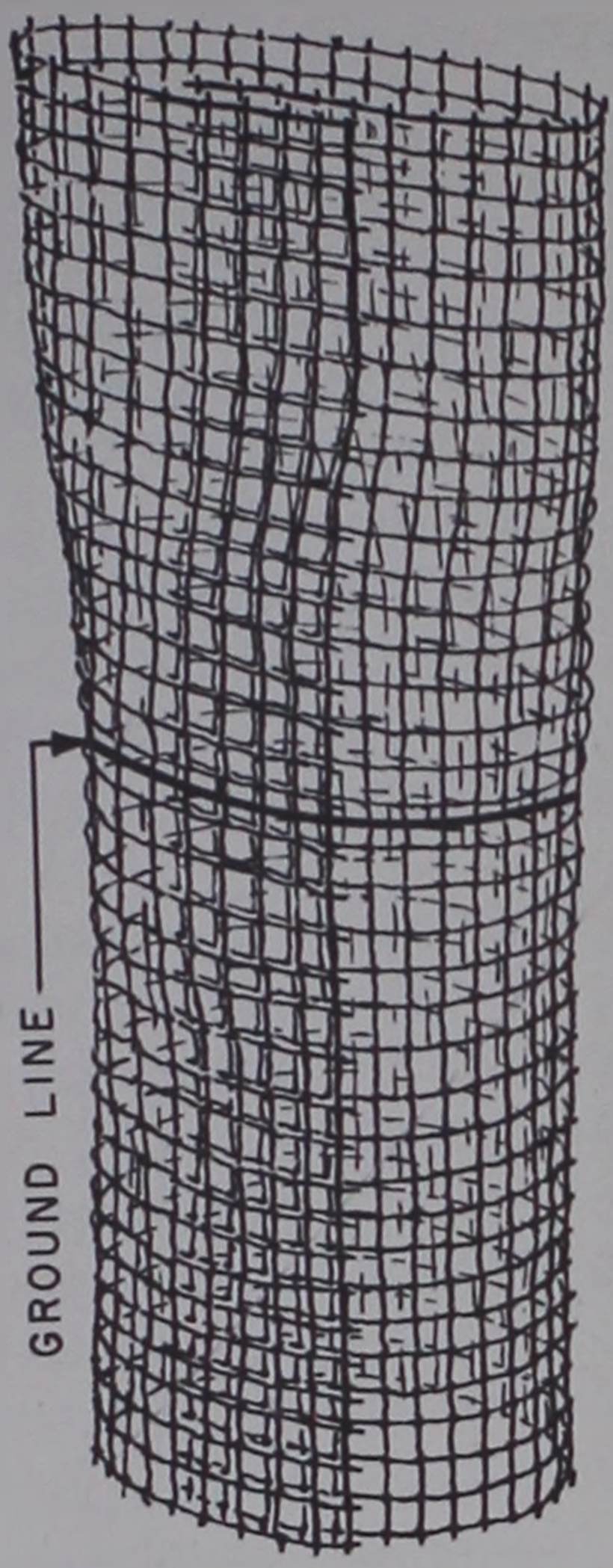
4. Center a screen over each seed spot. Set the screen into the ground at least an inch deep by twisting it down; otherwise it may be disturbed, and rodents will get the seed after all!

5. Remove the screens at the end of the first or second year so that seedlings will not be injured in trying to grow through them--and so you can use them again.

Material and labor costs are relatively high for these screens, and even though you use a set of screens several times, seed spotting with screens is as expensive as planting.

Small, inexpensive cylindrical screens, called K-screens, are now being tested as a possible means of reducing costs. K-screens are made from 4-inch squares of hardware cloth rolled around a broom handle or 3/4 inch pipe. The hardware cloth should be 4-mesh or finer.

These screens are set about 2 inches deep in dibble holes, and filled nearly to ground level with soil on which the seed is placed and covered. Then the top of the screen is pinched together to make an opening about 1/4 inch across. The theory is that rodents will not get at the seed, but the seedling will grow through the opening so the screen will not have to be removed. The screen will spread as the tree grows in diameter.




The K-screen has shown promise in small-scale tests. Rodent damage has been light, but seedling survival has been poor for other reasons. You may wish to test K-screens yourself, but better techniques for using them will have to be worked out before they can be recommended for large-scale use.

Poisoning the rodents is another method you can use to protect the seed. It has been fairly effective in some direct-seeding work. The procedure now used is to distribute poison bait, such as "1080" or thallium-treated oat groats, several weeks before seeding, on both the area to be seeded and a buffer strip

one-fourth mile wide. You'll need about one-half pound of poison bait per acre. A second poisoning when the seed starts to germinate may be necessary to make sure the seed or tender young seedlings are safe. You can determine the need for retreatment by setting traps to sample the rodent population. If you catch two animals in 100 trap-nights, the population is dangerously high. Remember, too, that under California law only duly authorized persons may distribute certain poison bait, so you had better check with your county agricultural commissioner about getting and using the bait.

Sowing the seed in prepared spots seems to be the best procedure when rodents are controlled by poisoning. By spot seeding you can make sure that all the seed is in mineral soil free of competition from brush and other plants. The seed can be sown by hand, using 5 seeds per spot. Or you can use one of the so-called walking stick planters designed to place and cover the seed by means of a spring mechanism. If the planter drops only 1 seed, you should sow 5 or 6 times the recommended 680 spots per acre.

All this may seem to be a lot of trouble just to get some seed in the ground, but the results will justify the work. Direct seeding will be successful with pine when you make sure there is:

1. A mineral soil seedbed.
2. Rodent control.
3. No competing vegetation.

# Planting

Planting nursery-grown trees has been more dependable, and over the years more successful than direct seeding. Care is the watchword here--care in handling, planting, and protecting the young trees. They are living plants, even though they are dormant when they are shipped and set in the ground. It's your job to keep them alive.

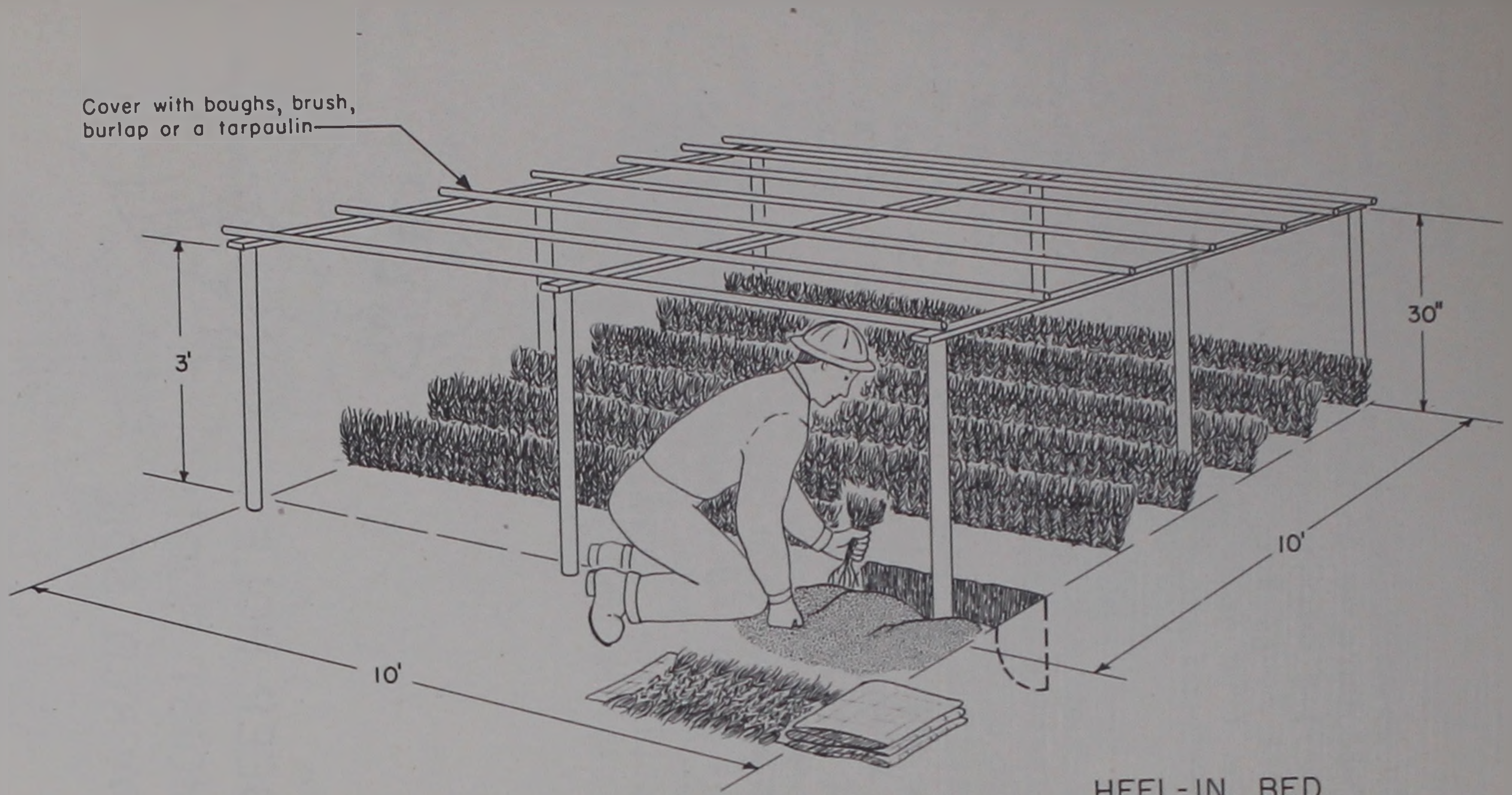
Start the planting job correctly at the very beginning, that is, in transporting the trees from the nursery to the man who will plant them. Here's the right way:

1. Keep the period in transit as short as possible. If more than 24 hours will be required, arrange for refrigerated transport. Shipments made by open truck should be covered with a canvas.

2. Unload the trees immediately on arrival. If they can be planted within two weeks, take them out of their containers and heel them in at the planting site. (See sketch of a heel-in bed.) If the trees must be held longer than two weeks, however, put the crates or bales in cold storage, keeping the temperature in the range of 32 degrees F. to 38 degrees F. and the relative humidity 80 percent to 90 percent. Be sure to stack the crates or bales so as to permit circulation of air.

3. If the trees are kept in storage, take only enough to the planting area for a day's work. If they are heeled in at the site, remove them only as needed. The less the trees are handled, the better.

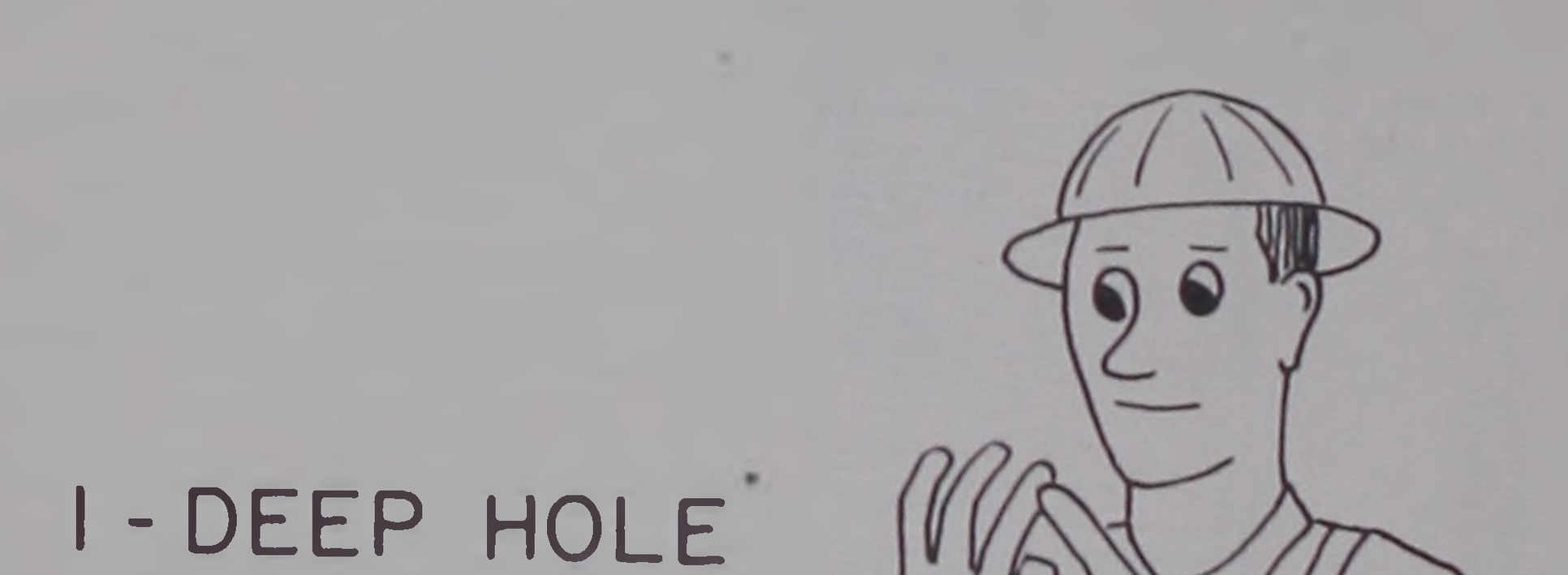
4. Distribute the trees to the planter in lots of 100. Pack them well in wet moss in the plant carrier (bag, tray, or pail). Be sure that the roots of the trees are protected with wet moss in the carrier at all times.




HEEL-IN BED

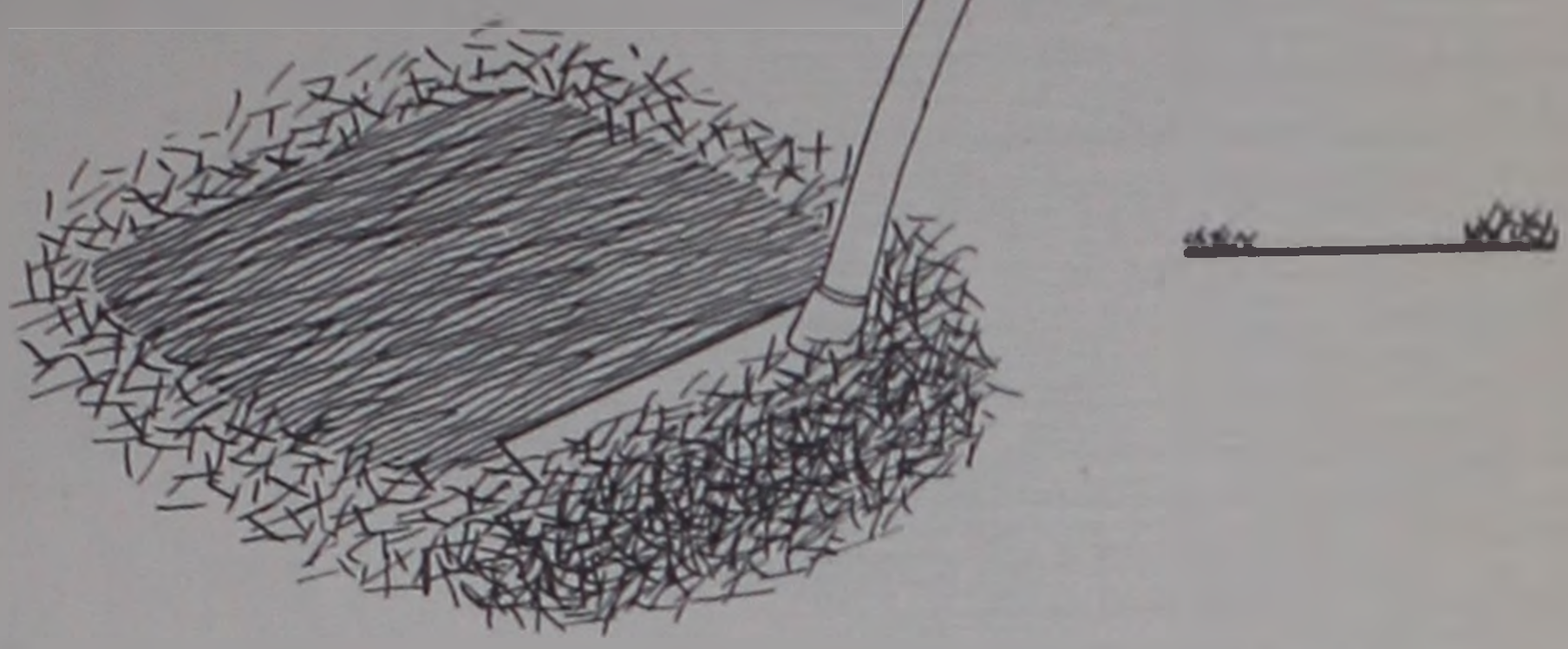
In setting the tree in the ground, you must take care to do these three things: Dig the planting hole at least as deep as the roots are long, keep the roots moist (handle only one tree at a time), and pack moist soil firmly around the roots.

Of course there are several ways of doing this by hand and by machine. In fact several tree planting machines now on the market do a good job quickly. But these machines work well only when the ground is flat or gently sloping and the soil surface is practically clear of brush, stumps, large stones, fallen trees, and logging debris. Such conditions in California forest areas are rare. So you'll probably have to rely on hand planting. The right way to do it is outlined on the next few pages. These sketches show, step-by-step, the method of planting that is recommended for the California pine region.



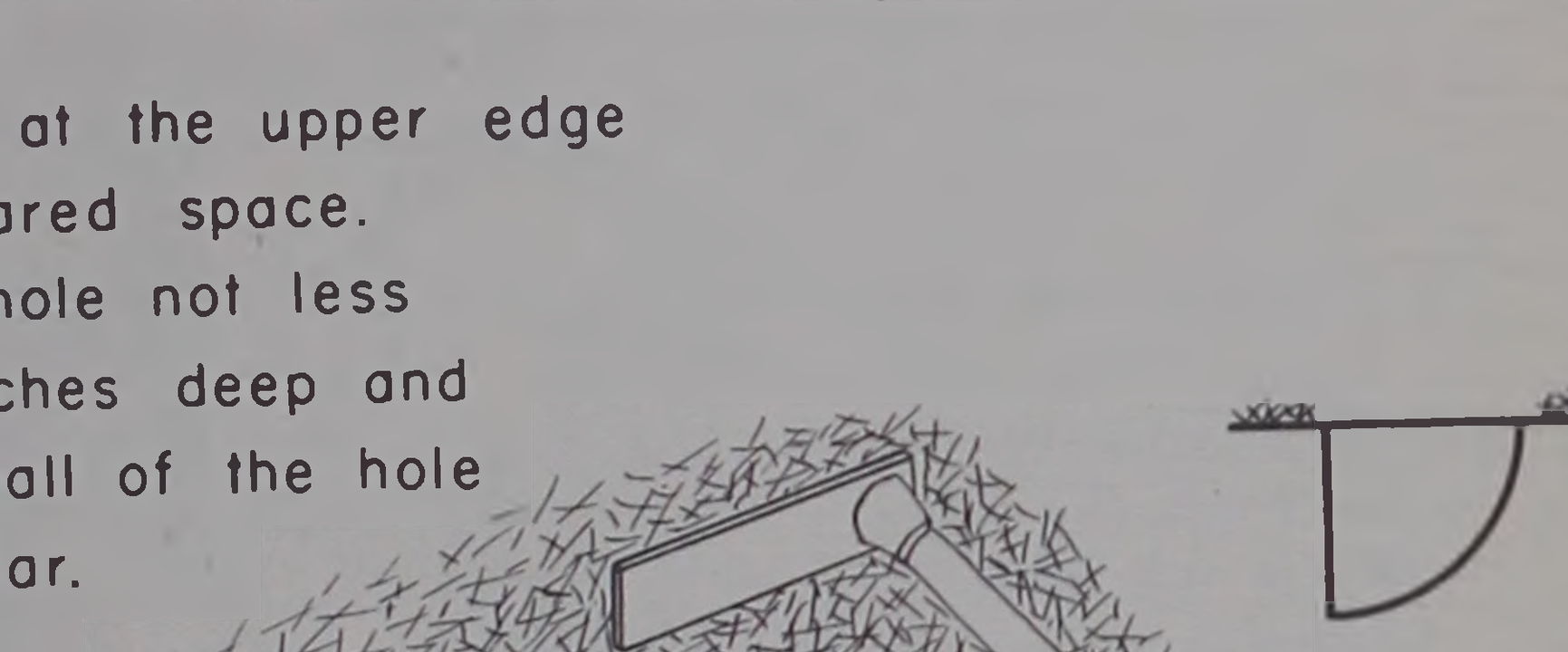
## ① PREPARE SPOT

Clear away litter and dry soil
from a spot 12- to 15- inches square.

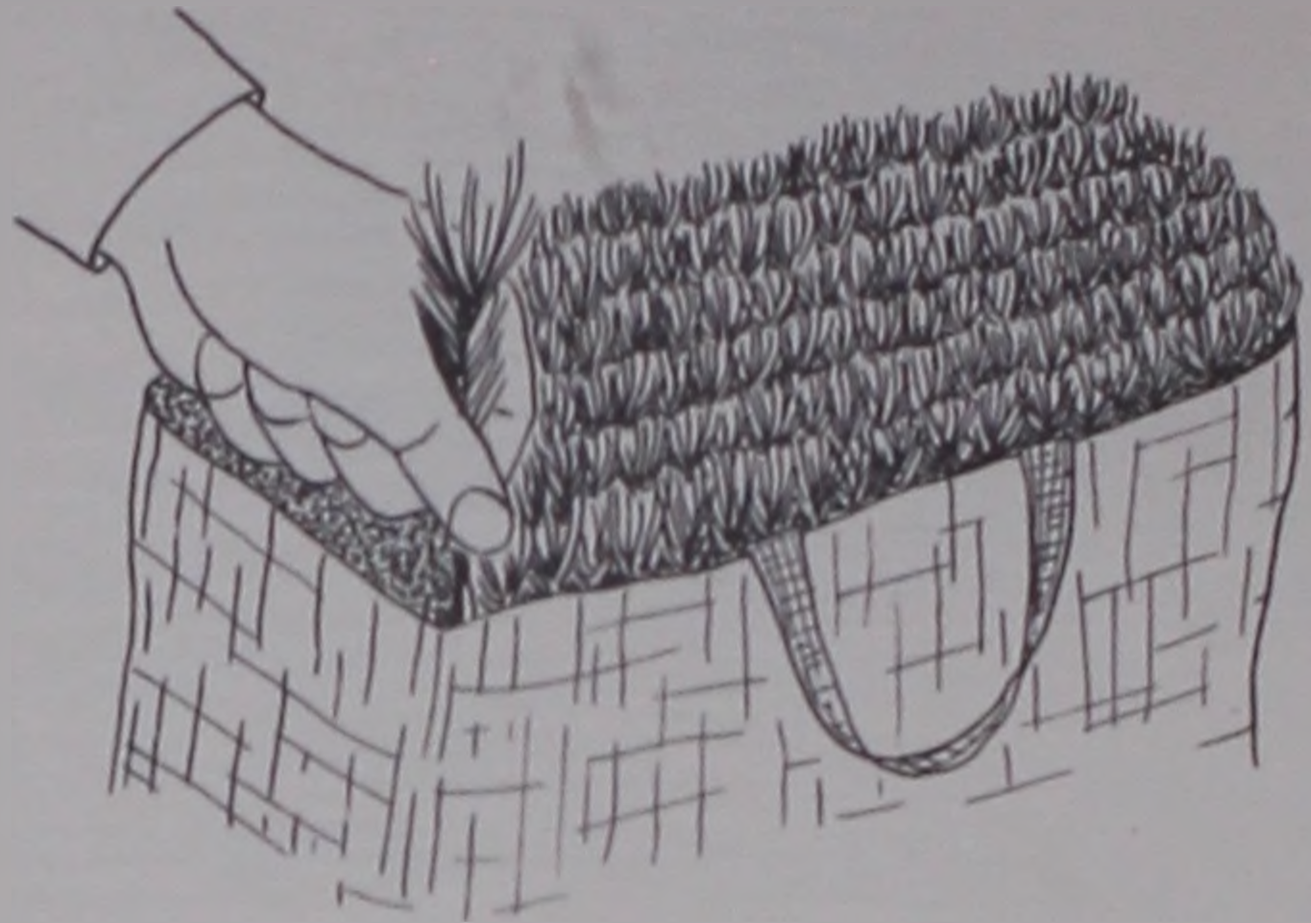


## ② DIG HOLE

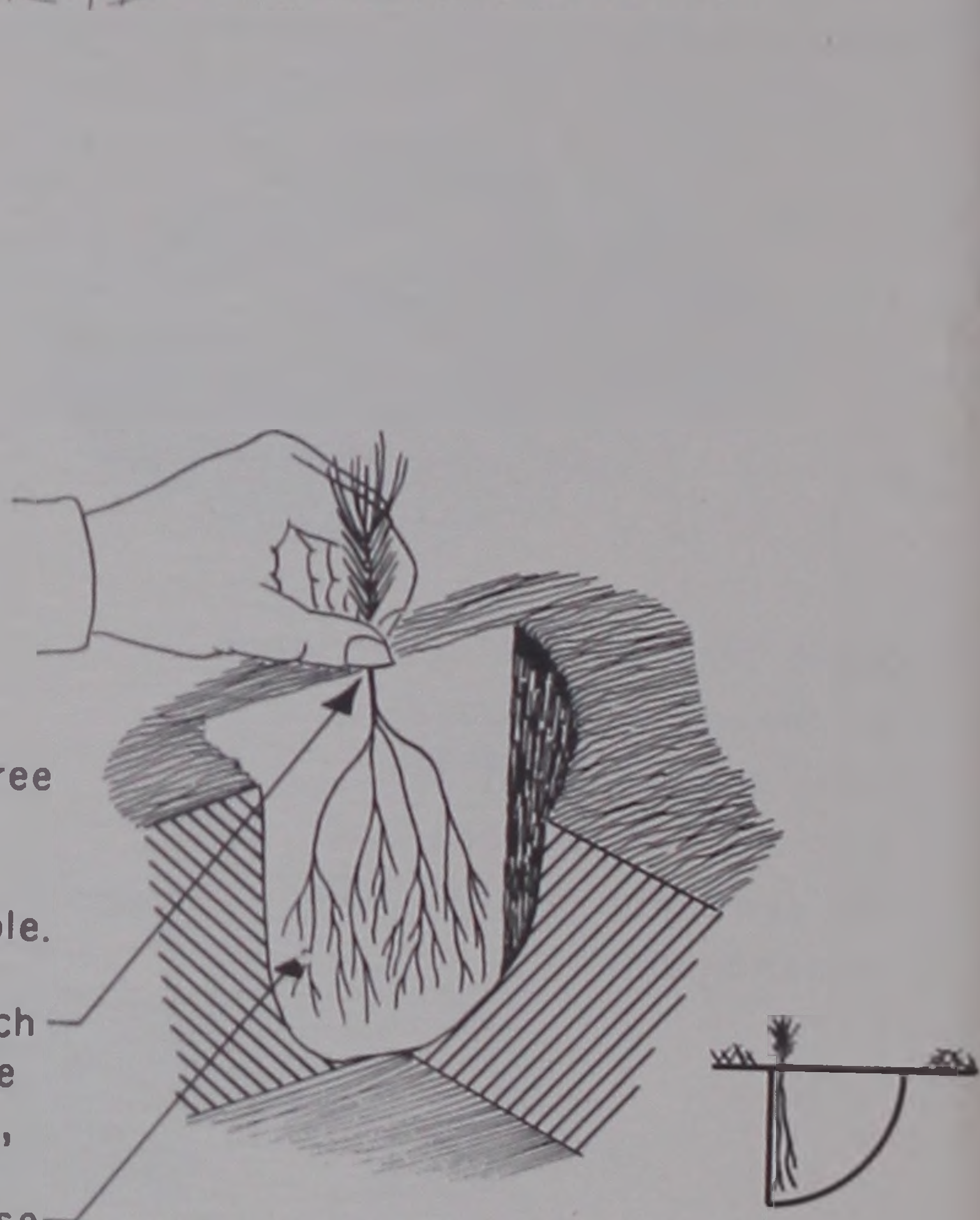
Dig a hole at the upper edge
of the cleared space.
Make the hole not less
than 10-inches deep and
the rear wall of the hole
perpendicular.



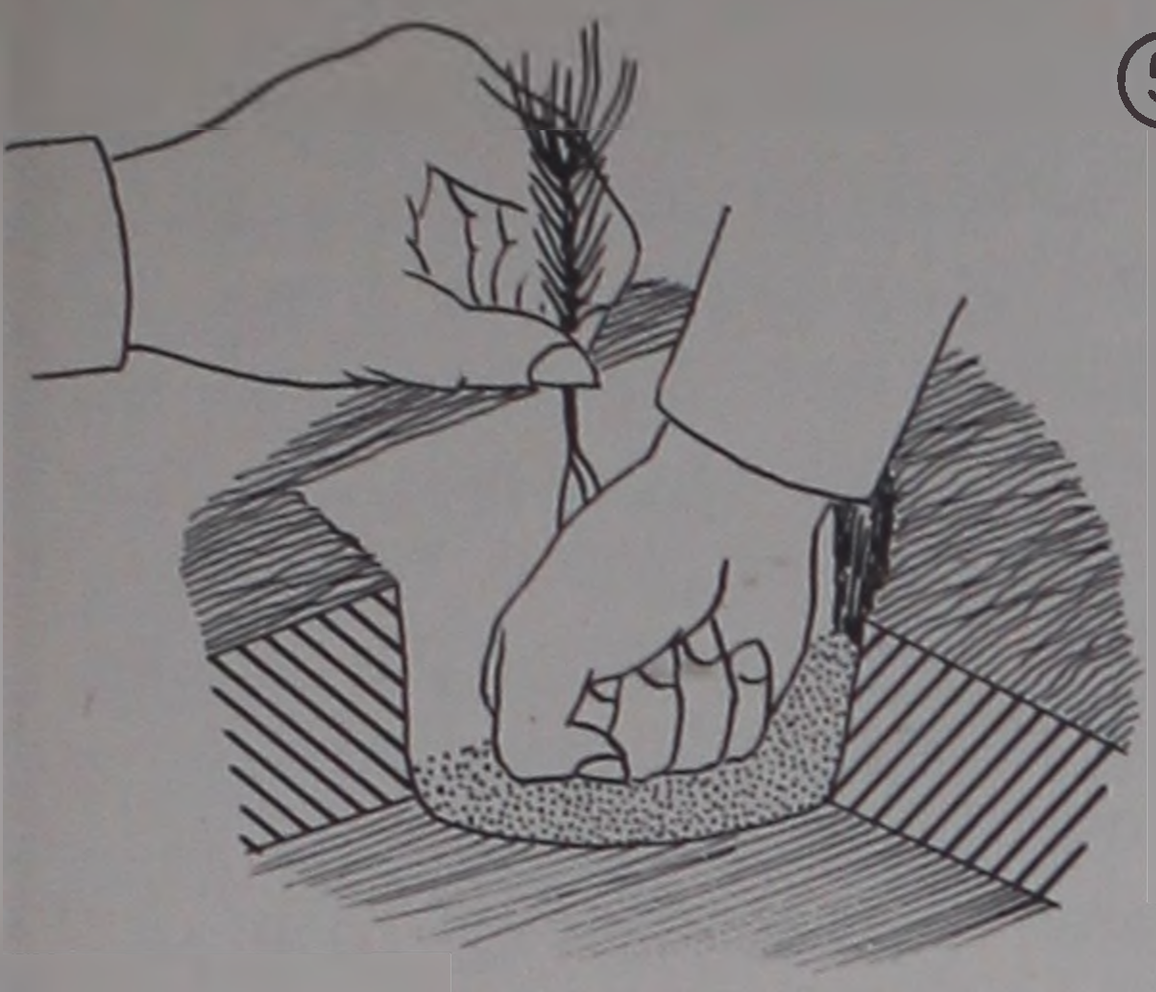
③ Remove ONE tree from the planting bag.



④ SET TREE

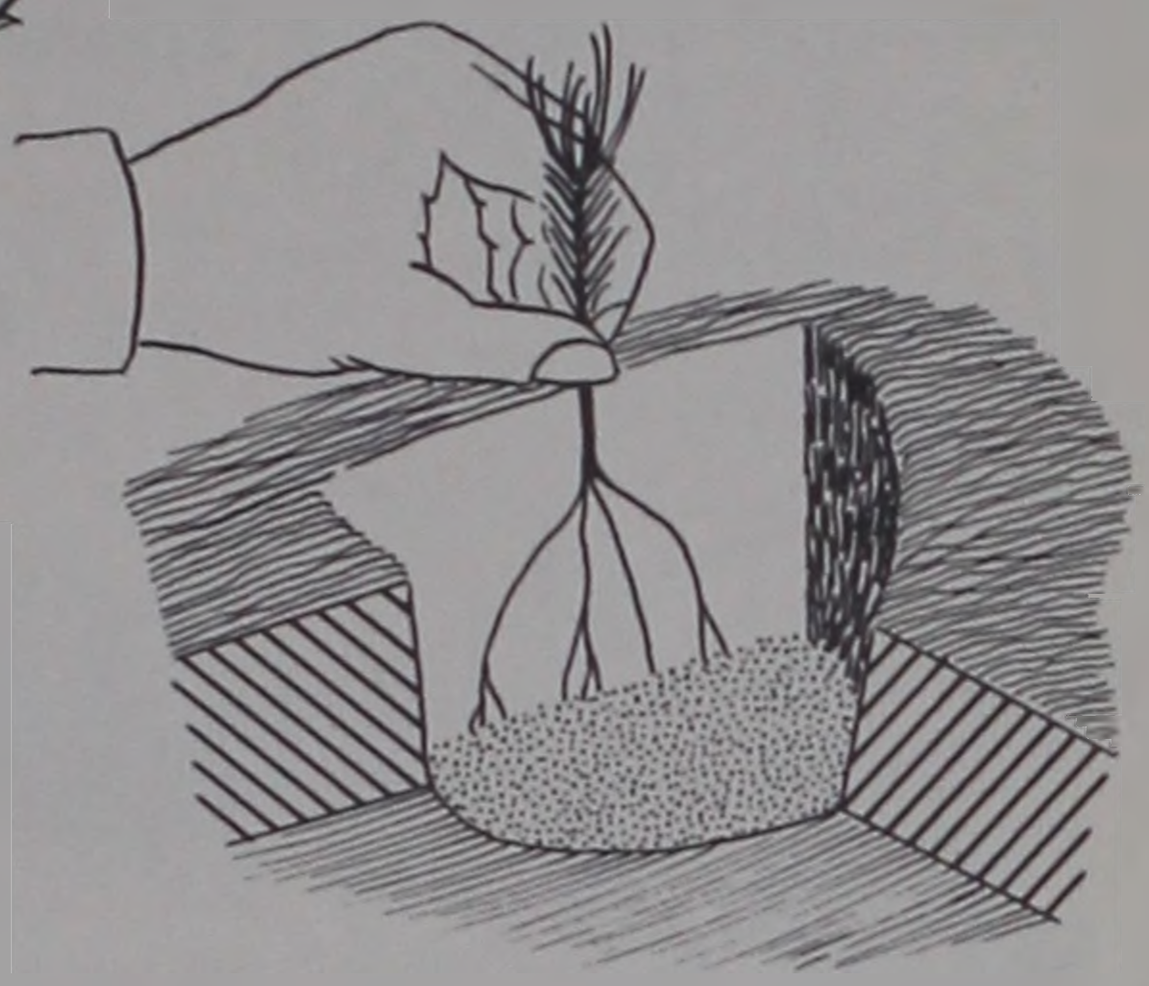


Suspend the tree against the perpendicular wall of the hole. Hold the first needles one inch no more — above the ground line, and spread the roots out fanwise

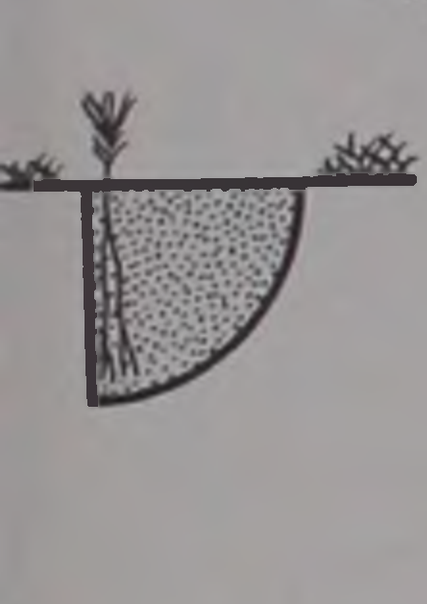


## ⑤ FILL HOLE

Holding the tree in position with one hand, fill half the hole with <u>moist</u> soil and tamp with the other hand.



Complete filling the hole with moist soil and tamp this firmly in place.

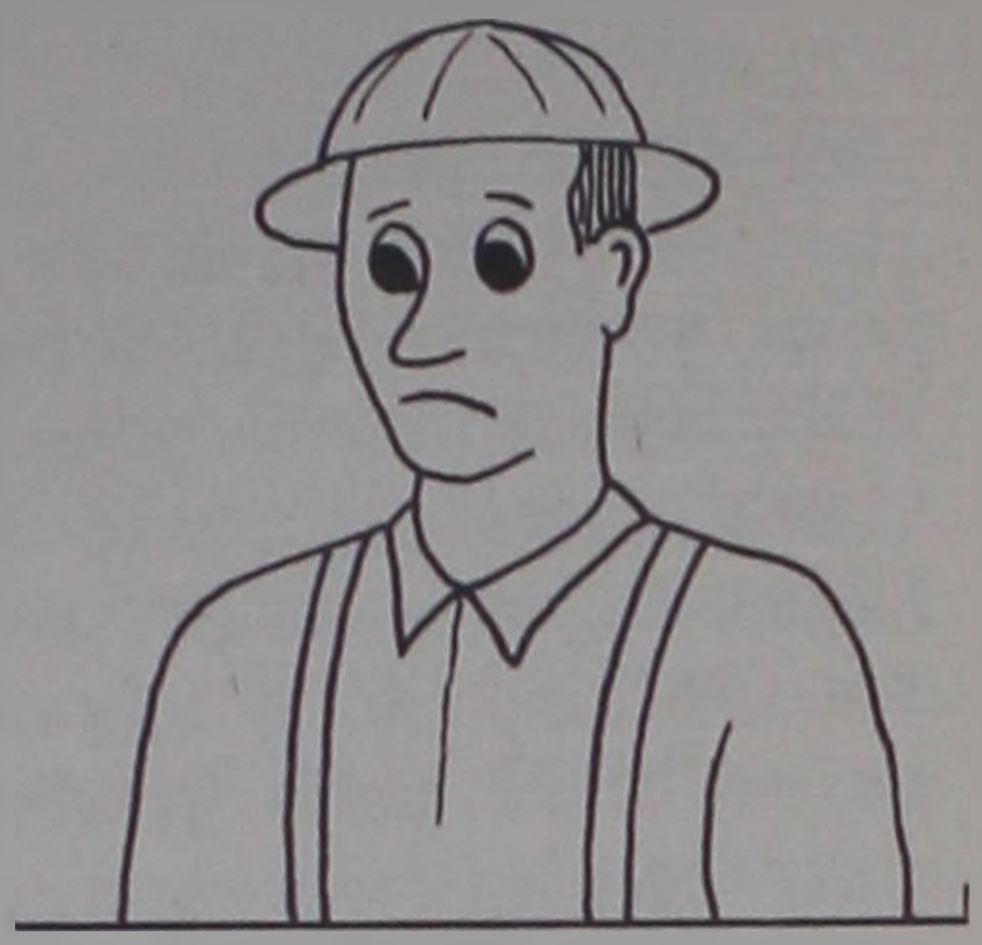


## ⑥ MULCH

Push loose earth and litter around the base of the tree.

Trees are usually planted 8 feet apart in rows 8 feet apart (680 trees to an acre), but it is far more important to plant each tree in the best spot you can find than to stick to a geometrical pattern. Planting the tree in the right spot often means the difference between failure and success. The more favorable spots are on the shady side of logs, stumps, and rocks. Avoid less favorable spots such as mounds or ridges of loose earth, rocky places

with little soil, depressions where water stands, accumulations of bark, chips, rotten wood, or other trash, severely burned soil, and any place within 5 feet of dense vegetation or a growing tree.



You can see by now that quality of workmanship should be stressed more than speed of planting. Careful, frequent inspection of the planters' work is necessary to make sure they are doing a good job. Here are some of the most common mistakes that you should look for:

1. Trees planted in unfavorable spots.
2. Poor preparation of the holes. "Pumping the handle" of the planting tool is a common fault. This action either makes a slit or a V-shaped hole which is then improperly closed.
3. Poor placement of the tree. Roots bunched or doubled up and rammed into the hole. Trees set too high or too low or planted in a horizontal position. Trees tucked into the hole with the blade of the tool.
4. Failure to tamp soil firmly around the roots and fill the hole with soil.
5. Failure to mulch around base of planted tree with loose soil or litter.
6. Removing more than one tree at a time from the plant container.

# Protecting the Plantation

Your planting job is not done when the last tree is planted. Much of the failure in past plantings has been the result of damage that could have been prevented if noticed in time. You ought to check the plantations at least once a year to see whether damage is occurring. Fit these checks into scheduled trips that take you near the plantation if you can, but if necessary make a special trip. If you find that the plantation is being damaged, take action immediately. Delay may be fatal. These are the chief sources of damage, and the protective measures you can take:

Grazing animals. Cattle, sheep, and deer often damage planted trees by browsing and trampling. For best results cattle should be excluded from planted areas for at least three years, and sheep should be excluded until the terminal buds, or growing tips of the planted trees, are out of reach of the sheep. If you direct-seed with screens, it's still best to keep cattle out because they kick over or trample the screens. Deer are more difficult; it is next to impossible to exclude them and the use of repellents is not yet practical. About the best you can do is avoid planting where you know that deer are numerous or likely to congregate.

Insects. One of the worst insect pests is the pine reproduction weevil, which has wiped out several plantations in California. Yellowing foliage is the most noticeable sign of weevil attacks. With a little whittling

you may find the tunnelled galleries of weevil larvae in twigs and stems of yellowed trees. Weevil-infested plantations can be saved, however, by early application of the proper insecticide. If you suspect that this insect is attacking the trees, ask the Forest Insect Laboratory, 29 Forestry Building, University of California, Berkeley, for instructions. You'll need to watch for damage by this insect until the trees are about 6 feet high; ordinarily the weevil does not attack larger trees. Damage by this insect has been most serious in the northern part of the state.

Porcupines. Porcupines seldom destroy entire plantations, but they do deform many trees, and kill some, by chewing off the bark. You can easily control porcupines, though, by putting poison salt in their dens and setting out poison salt blocks in trees in which they feed or rest. Of course it's best to do this as soon as you find evidence of damage--before the porcupines build up their population. Porcupine damage usually occurs in trees several inches in diameter so you will have to guard against it for a long time.

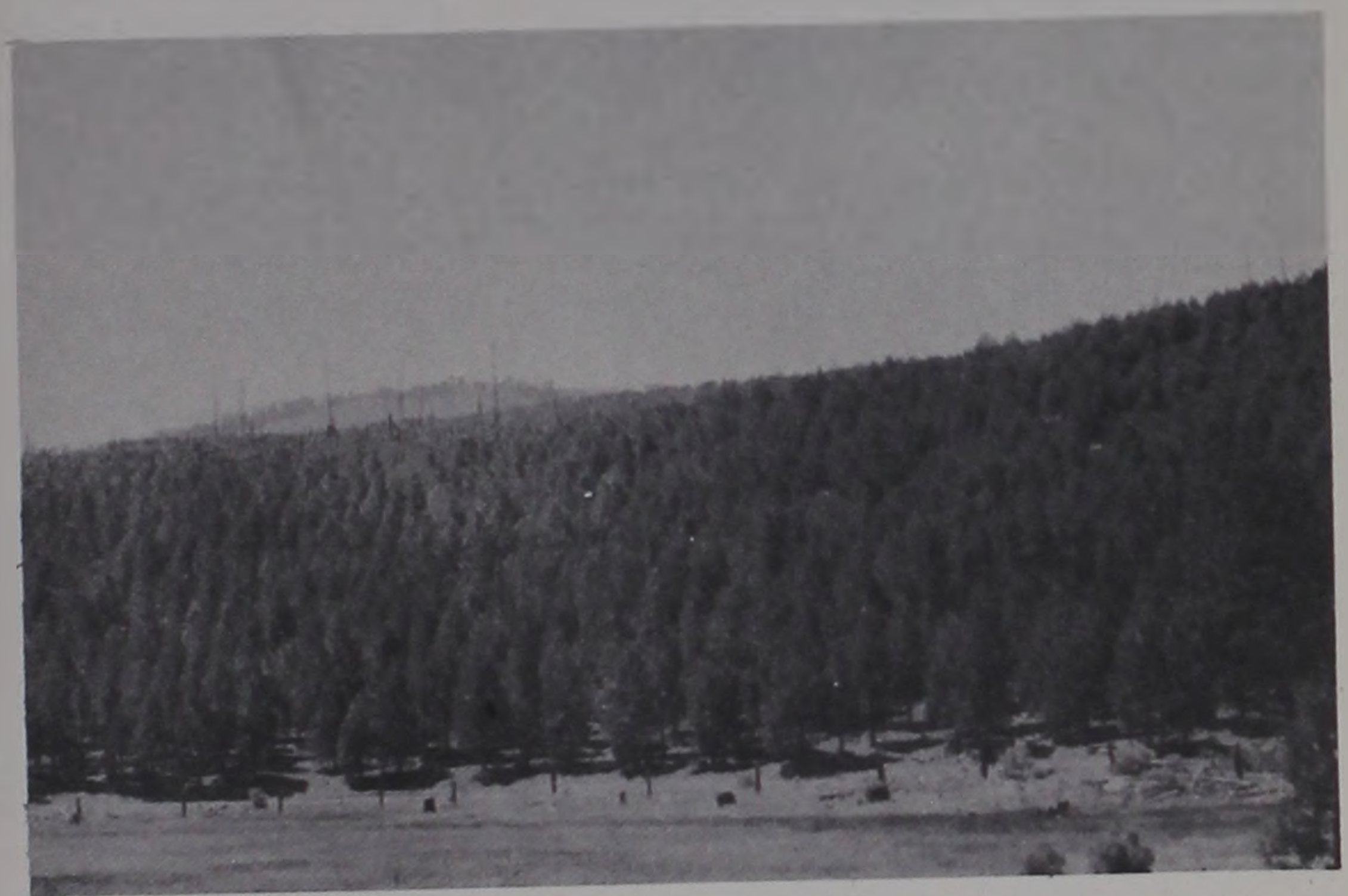
Rabbits. Rabbit damage has been most severe in brushfield plantations. Although no practical method of control has been discovered, the damage can be held low. Apparently these animals prefer to stay close to protective cover. Consequently damage can be minimized by planting in wide strips or blocks cleared of brush. Rabbits usually cause damage by nipping off the terminal bud. The trees are safe when they grow beyond the reach of the rabbits.

# WHAT IS SUCCESS?

Finally, what <u>is</u> the measure of a good planting job? Have you succeeded if most of the trees live through the first year? Well, not quite. Your goal is to have not less than 300 vigorous undamaged trees per acre at the end of 5 years. Count the trees periodically by running sample lines through the plantation to see if this goal is being met. If it is not and if brush has not taken over, replant the empty spaces with screened seed spots or nursery-grown trees.

Success is possible. Some excellent plantations attest to what can be done in the <u>right place</u>, at the <u>right time</u>, with the <u>right stock</u>, in the <u>right way</u>.

A 17-year-old plantation, established in 1932 on a timber burn in Modoc National Forest, Site III.



This plantation, established in 1933 on a timber burn, also was 17 years old when photographed. Modoc National Forest, Site III.

# SOME USEFUL REFERENCES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